1.3 μm $\lambda/4$-shifted AlGaInAs DFB-LD for 10Gbps operation

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Recently, the demand on the increase in the transmission bit-rate, such as over 10Gbps, in the optical data link system is getting stronger due to the worldwide popularization of internet. For these applications, uncooled 10Gbps operation 1.3 μm AlGaInAs DFB-LDs with uniform gratings has been reported [1][2]. However, DFB-LDs with uniform gratings tend to show unstable single-longitudinal-mode at high temperature and high power.

In this paper, we have realized high relaxation oscillation frequency (fr) of 11.2GHz(@5mW) in 1.3 μm AlGaInAs DFB-LD with $\lambda/4$-shifted grating which leads to a stable single-longitudinal-mode at high temperature and high power for the first time.

A schematic structure of the 1.3 μm AlGaInAs DFB-LD is shown in the Fig.1. An upper InGaAsP $\lambda/4$-shifted grating was formed by electron beam lithography only in the ridge waveguide. The GRIN-SCH active layer consisting of MQW with AlGaInAs quantum wells were grown by MOCVD. The ridge width was 2 μm and the cavity length is set at 200-300 μm with anti-reflection and anti-reflection (AR/AR) facet.

Figure 2 shows the light output power versus current (P-I) characteristics. As shown in the figure, the light output power over 5mW at 85℃ has been obtained for the DFB-LD despite of relatively low efficiency due to the AR/AR coating. The lasing spectra measured just below the threthold current and at 5mW output power at 25℃ are shown in Fig. 3. The single-longitudinal-mode has been observed inside the stopband due to the $\lambda/4$-shifted grating. The high SMSR over 40dB has been also obtained as shown in the Fig. 3(b).

Detuning dependence of fr at 25℃ is shown in Fig. 4. Fr as high as 11.2GHz(@5mW) at a negative detuning of -10nm at 25℃ has been obtained.

In conclusion, we have developed 1.3 μm $\lambda/4$-shifted AlGaInAs DFB-LD with high fr of 11.2 GHz(@5mW) for the first time. The LD is suitable for high bit-rate transmission in the optical data link system including gigabit ethernet over 10Gbps.

References

[1] Bo.Chen et al., Proceedings of International Semiconductor Laser Conf. (ISLC'98), pp.79-80, 1998

[2] M.Aoki et al., Proceedings of 5th Optoelectronics and Communications Conf. (OECC2000), pp.123-124, 2000

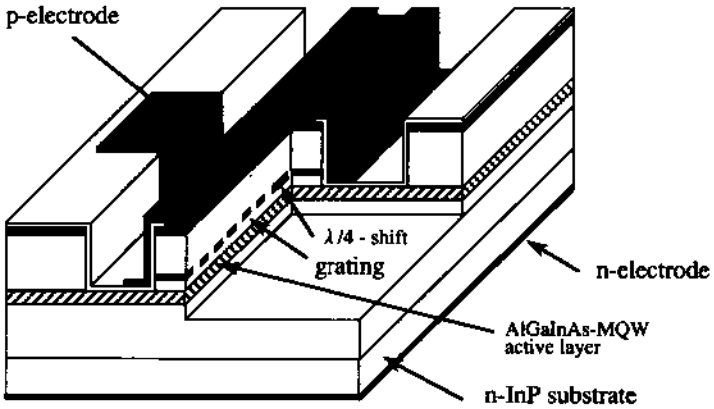


Fig. 1 Schematic structure of a 1.3 μ m AlGaInAs DFB-LD

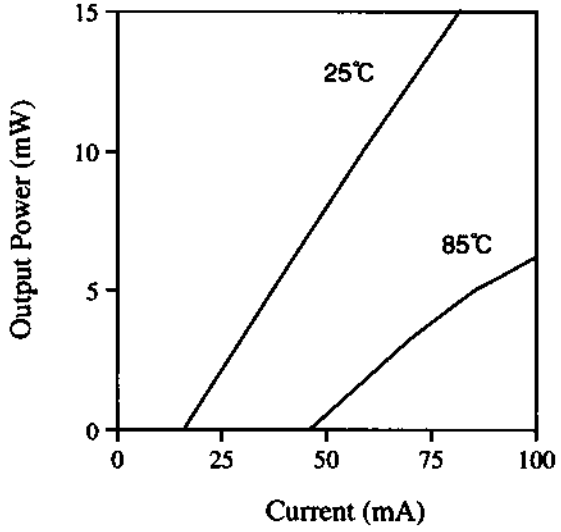


Fig. 2 Light output power versus current (P-I) characteristics

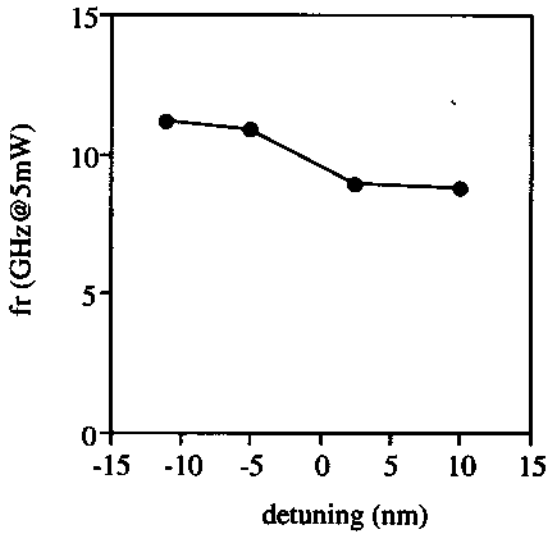
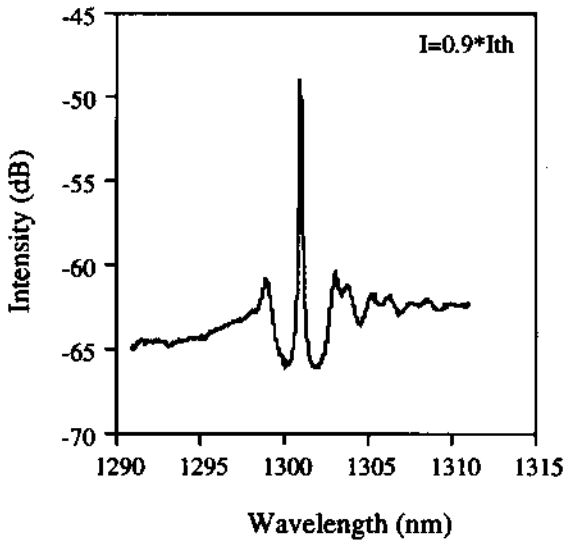


Fig. 4 Detuning dependence of relaxation oscillation frequency at 25℃



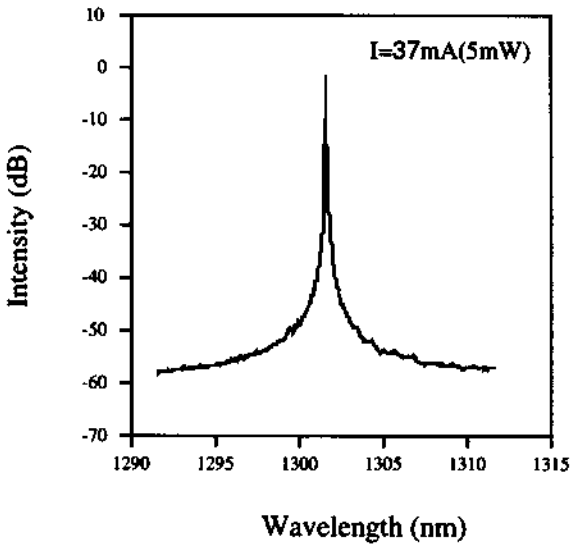


Fig. 3 Lasing spectra of at various injection current at 25℃